

APPLICATION FOR UNITED STATES LETTERS PATENT

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TITLE:

METHOD AND APPARATUS AT A DRAW
FRAME FOR FIBRE SLIVERS, FOR
ADJUSTING THE NIP LINE SPACING
OF A DRAWING MECHANISM

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SPECIFICATION

CROSS-REFERENCE TO RELATED APPLICATION

This application claims the priority of German Patent Application Nos. 102 42 388.1 filed September 13, 2002 and 103 5 29 836.3 filed July 2, 2003, the subject matters of which are incorporated herein by reference.

The invention relates to a method, at a draw frame for fibre slivers, of adjusting the nip line spacing of a 10 drawing mechanism, which has at least two drawing mechanism roller combinations, of which at least one is so mounted that it can be adjusted, wherein each drawing mechanism roller combination consists of at least one driven lower roller and at least one upper roller (press roller) lying 15 on top of the lower roller and so mounted that it can be lifted off, and encompasses an apparatus for carrying out the method.

In practice, adjustment of the nip line spacings is carried out without fibre slivers in the drawing mechanism, 20 that is to say the fibre slivers are drawn off from the drawing mechanism completely and, subsequently, the nip line spacings are adjusted. It is not possible, by that means, to optimise existing drawing mechanism settings whilst using the same fibre material.

In a known apparatus (DE-OS 20 44 996), the mountings of the intake and middle lower rollers are displaceable on the frame of the machine so that the extent of the drawing zone can be matched to the particular fibre staple. A tensioning 5 pulley wheel, which is displaceable in a guideway in the frame of the machine, allows the length of the toothed belt to be modified in accordance with the changed spacing between the axes of the middle roller and a guide pulley wheel, brought about by displacement of the intake roller.

10 The middle roller is driven by a further toothed belt. The latter toothed belt is tensioned by a tensioning pulley wheel which is fastened to the machine frame and which can pivot about one axis; as a result, it can also be matched to changed spacings between the axes of the intake roller and middle roller. It is disadvantageous that displacing 15 devices for displacement of the intake roller and the middle roller and additional tensioning devices for re-tensioning of the toothed belts after the displacement operations are necessary, requiring a considerable outlay

20 in terms of construction. In addition, it is disadvantageous that a number of work steps are required for the displacement operations and the subsequent re-tensioning operations. The belt tension is destroyed by the displacement process. Where the displacement is carried out 25 manually, spacers are inserted between the mountings, the mountings being pushed against the spacers so that, in this

case too, the amount of set-up work is considerable.

Finally, the displacement and re-tensioning operations result in a doubling of potential error sources when setting the spacings and belt tensions.

5 The problem underlying the invention is accordingly to provide a method of the kind described at the beginning that avoids the disadvantages mentioned and that especially allows optimisation of specific drawing mechanism settings using the same fibre material.

10 The problem is solved by the characterising features of claims 1 and 3.

The fact that adjustment of the nip line spacings is carried out with fibre slivers inserted allows, in accordance with the invention, optimisation of specific 15 machinery-related and/or fibre-related settings of the drawing mechanism using the same fibre material. The optimum extent of the drawing zone is dependent on, amongst other things, the length of fibres (staple length). It is likewise possible to determine and set an optimum drafting 20 value.

The invention also encompasses an advantageous apparatus at a draw frame having a drawing mechanism for the doubling and drafting of fibre slivers, having a drawing mechanism frame for accommodating the drawing mechanism, which has at 25 least two pairs of rollers each comprising an upper roller and a lower roller, having means for adjusting the spacing

of at least one of the lower rollers in relation to another lower roller, in each case having a mounting for accommodating the lower roller, wherein lower rollers are arranged to be driven by at least one drive element

5 endlessly revolving around pulley wheels, wherein at least one pulley wheel and the tensioned guide element are used for adjusting a slider (mounting), wherein a moving force applied to the pulley wheel or to the drive element can be converted into the adjusting movement for the slider.

10 Claims 2, 4 to 9, and 11 to 67 contain advantageous developments of the invention.

The invention will be described hereinafter in greater detail with reference to exemplary embodiments shown in the drawings, in which:

15 Fig. 1 shows, in a diagrammatic side view, an autoleveller draw frame for the apparatus according to the invention together with a general circuit diagram;

20 Fig. 2 shows the displaceable mounting of the intake and middle lower rollers;

Figs. 3a and 3b show the drive for the intake and middle lower rollers for the draw frame according to Fig. 1, in a side view

25 (Fig. 3a) and plan view (Fig. 3b);

Figs. 4a to 4d show, in diagrammatic form, the sequential procedure for shortening of the preliminary and main draft zones;

5 Figs. 5a and 5b show the intake and middle lower rollers before displacement (Fig. 5a) and after displacement (Fig. 5b);

Figs. 6a and 6b show, in diagrammatic form, an electro-magnetic braking apparatus for a toothed belt wheel;

10 Fig. 7 shows a locking device for a slider;

Fig. 8 shows a connection element (bridge) for connecting two sliders;

Fig. 9 shows an embodiment comprising a drawing mechanism having three roller

15 combinations, each having its own drive motor;

Fig. 10 shows input devices for manual and/or memory-assisted input of adjustment values for changing the nip line

20 spacings in the drawing mechanism; and

Fig. 11 shows an upper roller lifted off from a lower roller.

In accordance with Figure 1, a draw frame 1, for example a Trützschler HSR draw frame, has a drawing mechanism 2, upstream of which is an intake 3 of the drawing mechanism and downstream of which is an exit 4 from

the drawing mechanism. The fibre slivers 5, coming from cans (not shown), enter the sliver guide 6 and, drawn by the draw-off rollers 7, 8, are transported past the measuring element 9. The drawing mechanism 2 is designed as 5 a 4-over-3 drawing mechanism, that is to say it consists of three lower rollers I, II, III (I delivery lower roller, II middle lower roller, III intake lower roller) and four upper rollers 11, 12, 13, 14. Drafting of the fibre sliver combination 5' from a plurality of fibre slivers 5 is 10 carried out in the drawing mechanism 2. Drafting is composed of preliminary drafting and main drafting. The roller pairs 14/III and 13/II form the preliminary draft zone and the roller pairs 13/II and 11, 12/I form the main draft zone.

15 The attenuated fibre slivers 5 reach a web guide 10 in the exit 4 from the drawing mechanism and, by means of the draw-off rollers 15, 16, are drawn through a sliver funnel 17, in which they are combined to form one fibre sliver 18, which is then deposited in cans. Reference 20 letter A denotes the work direction.

The draw-off rollers 7, 8, the intake lower roller III and the middle lower roller II, which are connected to one another mechanically, for example by toothed belts, are driven by the control motor 19, it being possible, in the 25 process, for a desired value to be specified. (The associated upper rollers 14 and 13, respectively, revolve

by virtue of the motion of the lower rollers.) The delivery lower roller 1 and the draw-off rollers 15, 16 are driven by the main motor 20. The control motor 19 and the main motor 20 each have their own controller 21 and 22, 5 respectively. Control (speed-of-rotation control) is carried out in each case by means of a closed control loop, a tachogenerator 23 being associated with the control motor 19 and a tachogenerator 24 being associated with the main motor 20. At the intake 3 of the drawing mechanism, a 10 variable proportional to the weight of the fibre slivers 5 fed in, for example their cross-section, is measured by an intake measuring element 9 known, for example, from DE-A- 44 04 326. At the exit 4 from the drawing mechanism, the cross-section of the delivered fibre sliver 18 is 15 ascertained by an exit measuring element 25 associated with the sliver funnel 17 and known, for example, from DE-A- 195 37 983. A central computer unit 26 (control and regulation device), for example a microcomputer with a microprocessor, sends a setting for the desired value for 20 the control motor 19 to the controller 21. The measurement values of the two measuring elements 9 and 25 are sent to the central computer unit 26 during the drawing process. The desired value for the control motor 19 is determined in 25 the central computer unit 26 from the measurement values of the intake measuring element 9 and from the desired value for the cross-section of the delivered fibre sliver 18. The

measurement values of the exit measuring element 25 are used for monitoring of the delivered fibre sliver 18 (delivered sliver monitoring). By means of this control system, it is possible for variations in the cross-section 5 of the fibre slivers 5 fed in to be compensated, and for the fibre sliver to be made more uniform, by appropriately regulating the drafting process. Reference numeral 27 denotes a display monitor, 28 an interface, 29 an input device, 30 a pressure rod and 31 a memory.

10 In accordance with Fig. 2, the trunnions Ia, IIa, IIIa (see Fig. 3b) of the lower rollers I, II and III are mounted so as to be capable of rotation in mountings 32a, 33a, 34a (32b, 33b, 34b are located on the other side of the drawing mechanism and are not shown). The mountings 33a 15 and 34a are bolted onto sliders 35a and 36a, respectively, which are displaceable in the direction of the arrows C, D and E, F, respectively, along a bar 37a. The two ends of the bar 37a are fixedly mounted in mounting blocks 38' (38'' not shown), which are attached to the frame 39 of the 20 machine.

Displacement of the sliders 35a, 35b; 36a, 36b at the same time causes the mountings 33a, 33b; 34a, 34b and, as a result, the lower rollers II and III, respectively, to be displaced and moved in directions C, D and E, F, 25 respectively. The associated upper rollers 13 and 14 are correspondingly moved (in a manner not shown) in directions

C, D and E, F, respectively. By that means, the nip line spacings between the roller combinations are modified and set.

Locking of the sliders 35a, 35b; 36a, 36b is 5 accomplished by means of a catch device, stopping device or the like (see Fig. 7).

In accordance with Fig. 3a, the lower rollers II and III are driven from the right-hand side, seen in the direction of material flow A, by means of a common loop mechanism in the form of toothed belt wheels 40, 41 and a toothed belt 47. The different speeds of rotation of the lower rollers II and III are achieved by means of change-gearwheels at the drive trunnions IIa, IIIa provided with different numbers of teeth. The toothed belt 47 runs in 15 direction B (that is to say contrary to the work direction) onto the control drive, which is in the form of a servo motor 19. The lower roller I is driven from the left-hand side of the machine by means of a loop mechanism in the form of toothed belt wheels and a toothed belt 47. For that 20 purpose, the toothed belt 47' runs on the left-hand side from the toothed belt disc 40 at the lower roller I in direction G onto the servo motor 20.

In operation, that is to say when the fibre slivers are running in direction A, the toothed belt 47 moves in 25 direction G. Starting from the toothed belt wheel 47 arranged on the drive motor 19, the toothed belt 47 runs

successively over a toothed belt wheel 45, a smooth guide pulley wheel 46, the toothed belt wheel 40 (roller-driving pulley wheel for the lower roller III), the toothed belt wheel 41 (roller-driving pulley wheel for the lower roller II), a smooth guide pulley wheel 42 and a toothed belt wheel 43. By means of its teeth, the toothed belt 47 is in positive engagement with the toothed belt wheels 40, 41, 43, 44 and 45. The smooth side (reverse) of the toothed belt 47, opposite the toothed side, is in contact and in engagement with the smooth guide pulley wheels 46 and 42. The toothed belt 47 loops around all the pulley wheels 40 to 46. In operation (when the fibre slivers are running in direction A during drafting), the toothed belt wheels 40, 41, 43, 44 and 45 rotate clockwise and the guide pulley wheels 42 and 46 rotate anti-clockwise.

The toothed belt wheels 40, 41 are associated with the mountings 34a and 33a, respectively, whereas the guide pulley wheels 42, 46 are attached to the sliders 35a and 36a, respectively, in a manner allowing rotation. Because of the rigid attachment between the mounting 34a and the slider 36a and between the mounting 33a and the slider 35a (for example, by means of bolts), there are associated with the lower rollers II and III, in each case, one toothed belt wheel 40 to 41 and one guide pulley wheel 46 and 42, respectively. The toothed belt 47 runs around the pulley wheels 40, 46, on the one hand, and around the pulley

wheels 41, pulley wheel 42, on the other hand, in a mirror-reflected arrangement (see Fig. 3b).

The zone between the pairs of rollers 13/II and 14/III is designated VV (preliminary drafting) and the zone 5 between the pairs of rollers 12/I and 13/II is designated HV (main drafting) (see Fig. 4a). When, in accordance with Fig. 3a, the nip line spacing between the roller pairs 14/III and 13/II is to be increased, at least one pair of rollers must be moved away from the respective 10 other pair of rollers. For that purpose the slider 35a may be displaced towards the right, which may be accomplished in two ways:

a) The slider 35a is unlocked. A pulley wheel, for example the toothed belt wheel 44, is stopped so 15 that there is no possibility of rotation. Stopping may be accomplished, for example, by mechanical or electromagnetic means. As a result the toothed belt 47 is stationary and cannot be moved. The toothed belt wheel 41 is then rotated anti-clockwise, for example manually using a crank or the like, whereupon the guide pulley wheel 42 20 likewise rotates, clockwise, as a matter of necessity. In the process, the rotary movement of the toothed belt wheel 41 is converted into a longitudinal movement of the slider 35a in 25 direction C, the toothed belt wheel 41 and the

guide pulley wheel 42 winding along opposite sides of the stationary toothed belt 47, thereby "shortening", as it were, the toothed belt 47 at one pulley wheel and "lengthening" it at the other pulley wheel. The length of belt required during that "winding along" at the toothed belt wheel 41 is made available at the guide pulley wheel 42.

The lower roller II is thereby displaced in direction C by means of the slider 35a and the mounting 33a.

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b) The slider 35a is unlocked. The toothed belt wheel 41 is stopped so that there is no possibility of rotation. As a result the guide pulley wheel 42 is also stopped of necessity. Then, clockwise rotation is brought about by means of the drive motor 19. The toothed belt 47 moves in direction G, likewise "shortening" the belt 47 at one pulley wheel and "lengthening" it at the other pulley wheel. The length of belt actually required between the toothed belt wheels 40 and 41 is made available between the toothed belt wheels 43 and 42. The rotary movement of the toothed belt wheel 44 and the movement of the toothed belt 47 is thereby converted into a longitudinal movement of the slider 35a in direction C. The lower roller II, mounted in the

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mounting 33a (which is rigidly connected to the slider 35a), is likewise moved in direction C as a result.

In practice, it is often the case that, in accordance with Figs. 4a to 4d, first the preliminary draft zone VV is modified and then the main draft zone HV. In the case of shortening of the draft zones VV and HV, the slider 36a is displaced in the direction of the arrow E from the position according to Fig. 4a into the position according to Fig. 4b. As a result, the nip line spacing in the preliminary draft zone VV is reduced from "a" to "a'". Then, in accordance with Fig. 4c, the sliders 36a and 35a are rigidly connected to one another by means of a bridge 50. Finally, the rigidly coupled sliders 36a and 35a are moved, in accordance with Fig. 4d, in the direction of the arrows E and C, from the position shown in Fig. 4c into the position shown in Fig. 4d. As a result, the nip line spacing in the main draft zone HV is shortened from "b" to "b'". - A corresponding procedure is used in the case of lengthening the preliminary and main draft zones, that is to say the coupled sliders 35a and 36a are displaced in the direction of the arrows F and D (see Fig. 2), as a result of which the main draft zone HV is lengthened. Then, the sliders 35a and 36a are uncoupled from the bridge 50. Finally, the slider 36a is moved in the direction of the

arrow F (see Fig. 2), as a result of which the preliminary draft zone VV is lengthened.

With regard to the fibre slivers 5 in the drawing mechanism 2, it should be noted that, in the case of shortening of the draft zones VV and HV, a small amount of stretching, in direction B, of the fibre slivers 5^{IV} upstream of the pair of rollers 14/III can occur on displacement in accordance with Figs. 4a, 4b, but because of the length (about 1.5 m) of the spacing between the transport rollers 7, 8 and the pair of rollers 14/III this is without significance. In the case of shortening, a sagging loop does not form in the preliminary draft zone VV because in the case of displacement referring to the pairs of rollers 14/III and 13/II either one or both pairs of rollers are rotatable because the drives to both pairs of rollers are coupled by way of the toothed belt 47. In contrast, in the case of shortening of the main draft zone HV, a sagging loop is formed in fibre slivers 5'', which is drawn out or drawn straight by rotation of the pair of rollers 12/I in the work direction A by means of the main motor 20. - In the case of lengthening of the draft zones VV and HV, the pair of rollers 12/I is, in a first step, rotated backwards in direction B, whereupon a sagging loop is intentionally formed in the fibre slivers 5''. When the main draft zone HV is subsequently lengthened by displacement of the coupled sliders 35a and

36a in direction D and F, the artificially formed loop is, in the process, once again drawn out or drawn straight. Finally, after uncoupling of the bridge 50, the slider 36a is displaced in direction F. As a result of the above- 5 mentioned coupling of the drives to the intake and middle lower roller pairs by means of the toothed belt 47, the length of the fibre slivers 5' in the preliminary draft zone VV remains unaffected. Possible slight compression of the fibre slivers 5^{IV} upstream of the pair of rollers 10 14/III is, in respect of the drafting and the constitution of the fibre slivers 5^{IV}, without significance.

Figs. 5a, 5b show the construction bringing about the displacement of the sliders 36a and 35a. The nip line spacing in the preliminary draft zone VV is lengthened from 15 "a" (Fig. 5a) to "a'" (Fig. 5b). The sliders 36a and 35a are displaced one after the other according to the arrows E and C, respectively. Displacement is accomplished by stopping the toothed belt wheel 40 or fixing it with a holding brake or the like and then actuating the drive 20 motor 19, whereupon the toothed belt 47 moves. In continuation thereof, the sliders 36a and 35a are displaced in accordance with Figs. 4a, 4b and, subsequently, Figs. 4c, 4d.

In accordance with Fig. 6a, an electromagnetic holding 25 brake is provided, which has a rod-shaped iron core 53 surrounded by a plunger coil 54. Mounted on one end face of

the iron core 53 is a brake shoe 55, for example made of plastics material or the like. The iron core 53 is displaceable in the direction of the arrows M, N. When current flows through the plunger coil 54, the iron core 53 5 is moved in direction M, in accordance with Fig. 6b, so that the brake shoe 55 is pressed against the smooth cylindrical surface of the shaft 44a of the toothed belt wheel 44. As a result, the toothed belt wheel 44 is fixed (stopped) so that it cannot rotate, for as long as voltage 10 is applied to the plunger coil 54.

In accordance with Fig. 7, a pneumatic cylinder 60 having a piston rod 61 is attached to the slider 36a. When subjected to pressure from the pneumatic cylinder 60, the piston rod 61 is moved out in the direction of the arrow P 15 and comes to rest, with a high degree of contact pressure, against the machine frame 61. The slider 36a is fixed (stopped) so that it cannot be displaced with respect to the bar 37a, for as long as compressed air is applied to the pneumatic cylinder 60.

20 In accordance with Fig. 8, there is provided, as the bridge 50 between the sliders 35a and 36a, a flat piece of metal (plate), which is fastened in the region of one of its ends 50a to the slider 36a, for example using bolts. In its region 50b facing the slider 35a, the flat piece of 25 metal has an elongate hole 50c, through which a bolt 62 can engage in a threaded hole (not shown) in the slider 35a. By

means of this bridge 50, the sliders 35a and 36a can be rigidly connected to one another, releasably, at different spacings with respect to one another.

In accordance with Fig. 9, in contrast to Fig. 1, each 5 lower roller I, II and III is driven by its own drive motor 20, 52 and 19, respectively, as shown, for example, in DE-OS 38 01 880. The motor 20 drives the toothed belt wheel 55 of the lower roller I by way of the toothed belt 56; the motor 52 drives the toothed belt wheel 41 of 10 the lower roller II by way of the toothed belt 57; and the motor 19 drives the toothed belt wheel 40 of the lower roller III by way of the toothed belt 47. Attached to the slider 36a, in addition to the smooth guide pulley wheel 46, is a further smooth guide pulley wheel 51. The 15 endless toothed belt 47 loops around, in succession, the pulley wheels 44, 46, 40, 51 and 43. The toothed belt wheels 44, 40 and 43 are in engagement with the teeth of the toothed belt 47, whereas the smooth guide pulley wheels 46 and 51 are in engagement with the smooth reverse side of the toothed belt 47. The sliders 35a and 36a are 20 rigidly connected to one another, releasably, by means of the bridge 50. When they are not connected by the bridge 50, the sliders 35a and 36a are individually displaceable and when they are connected by the bridge 50 25 they are jointly displaceable.

In accordance with Fig. 10, the drive motor 19 for lower rollers II and III is in communication with the electronic control and regulation device 26. Adjustment values for modification of the draft zones VV and HV (that is to say the extents of the drawing zones) either can be entered manually by way of the input device 29 or can be called up from a memory 31 for particular categories of fibre material.

Adjustment of the nip line spacing in the preliminary draft zone VV and/or the main draft zone HV can be carried out with the fibre slivers 5 inserted.

Displacement can be carried out with the upper rollers 11 to 14 in the loaded state. Figs. 1 and 10 show inserted fibre slivers 5 and loaded upper rollers 11 to 14. With the fibre slivers inserted and the upper rollers 11 to 14 loaded, the sliders 35a, 36a or mountings of at least one lower roller II, III are unlocked, the sliders or mountings are set to the desired nip line spacing a, a'; b, b' by means of a displacement device, for example in accordance with Figs. 3a, 3b; 5a, 5b and then the sliders 35a, 36a or mountings are locked again (for example in accordance with Fig. 7).

Displacement can also be carried out with the upper rollers 11 to 14 lifted off. The upper rollers 11 to 14 may be lifted off completely from the lower rollers I to III in the manner shown in DE-OS 197 04 815, the upper roller 14

being swung out on a portal 58 about a pivot mounting 59. However, it may also be sufficient for the upper rollers 11 to 14 to be unloaded and to be lifted off from the lower rollers I to III only to a slight degree such that the 5 fibre slivers 5 are not caught by the pairs of rollers during displacement of the draft zones VV and HV but can slide through the roller nip without being adversely affected.

The invention has been illustrated using the example of 10 the adjustment of the nip line spacings of a drawing mechanism of a draw frame. It likewise encompasses the adjustment of drawing mechanisms of other machines, for example carding machines, combing machines, fly frames and ring spinning frames.